

TREE NESTING BY THE GYRFALCON (*Falco rusticolus*) IN THE WESTERN CANADIAN ARCTIC

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ABSTRACT.—Tree nesting by the gyrfalcon (*Falco rusticolus*) has been reported rarely in North America (41 records from 1861–1992). Between 1987–1993, I studied 28 cases of tree nesting in 16 gyrfalcon territories in the forest/tundra of the western Canadian Arctic. Tree-nesters used nests of common raven (*Corvus corax*), in 6–12-m-tall white spruce (*Picea glauca*). Tree nests used were in poor condition, small and exposed. The mortality rate of eggs and young was higher in tree nests than in nearby cliff nests, so the mean brood size was significantly smaller in tree nests. Mean internest distance of occupied gyrfalcon nest sites in high density areas was 5.3 km for clusters of tree and 5.4 km for clusters of cliff nesters. This finding suggests that tree nesting occurs commonly in the forest/tundra zone, indicating that gyrfalcons may be more numerous than generally thought.

KEY WORDS: *Canadian arctic; Falco rusticolus; gyrfalcon; reproduction; tree nesting.*

La nidificación en árboles por *Falco rusticolus* en el oeste del Ártico canadiense

RESUMEN.—La nidificación en árboles por *Falco rusticolus* ha sido raramente informada en Norteamérica (41 registros desde 1861–1992). Entre 1987 y 1993, estudié 28 casos de nidificación en árboles ubicados en 16 territorios de *F. rusticolus* en el bosque-tundra al oeste del ártico canadiense. Los individuos que nidificaron en árboles usaron nidos de *Corvus corax* ubicados en *Picea glauca* de 6 a 12 m de altura. Los nidos utilizados estaban en pobres condiciones, pequeños y expuestos. La tasa de mortalidad de huevos y juveniles fue más alta en nidos ubicados en árboles que aquellos situados en riscos. El tamaño medio de la nidada fue significativamente más pequeño en nidos ubicados en árboles. La distancia promedio entre nidos ocupados por *F. rusticolus* en áreas de alta densidad fue de 5.3 km para agrupaciones de árboles y 5.4 km para agrupaciones de individuos que nidificaban en riscos. Estos datos sugieren que la nidificación en árboles ocurre comúnmente en la zona de bosque-tundra, indicando que *F. rusticolus* puede ser más numeroso de lo que generalmente se piensa.

[Traducción de Ivan Lazo]

Most gyrfalcon (*Falco rusticolus*) nests are situated on cliffs in tundra habitat. Tree nesting in the forest/tundra has, however, been recorded regularly in Eurasia but only rarely in North America (Dement'ev et al. 1951, Dement'ev 1960, Newton 1979, Cade 1982, Palmer 1988). Here I describe my observation of tree-nesting gyrfalcons in the western Canadian Arctic, from 1987–1993.

STUDY AREA

I conducted research in the western Canadian Arctic on the Horton River and adjacent areas (Fig. 1). The study area was 3300 km² of dwarf shrub-sedge-lichen tundra, and 1700 km² of open-canopied white spruce (*Picea glauca*)-lichen-shrub woodland. The country is flat or rolling, and elevation declines from 500–200 m above sea level toward the arctic coast.

January and July mean temperatures at the community of Paulatuk (Fig. 1) are -29° and 13° C, respectively, and annual mean precipitation is 260 mm. Snow cover lasts for about 260 d, with snow melt beginning in mid- to late-May (data from Atmospheric Environment Service, Edmonton).

METHODS

I conducted gyrfalcon surveys by canoe, on foot, and by airplane (Piper Supercub) between mid-May to August in 1987, and 1989–1993 ($\bar{x} = 6$ wk/yr). Tree nest sites were visited on the ground once every year (1989–1993) during the nestling period, and occasionally also during the incubation and fledging periods. The same procedure was conducted for some cliff and bank nest sites (1987, and 1989–1991).

The terminology is based on the definitions in Poole and Bromley (1988) as follows: "Territory—an area containing one or more nest sites within the range of a pair of actual or potential breeders. Nest site—the actual site

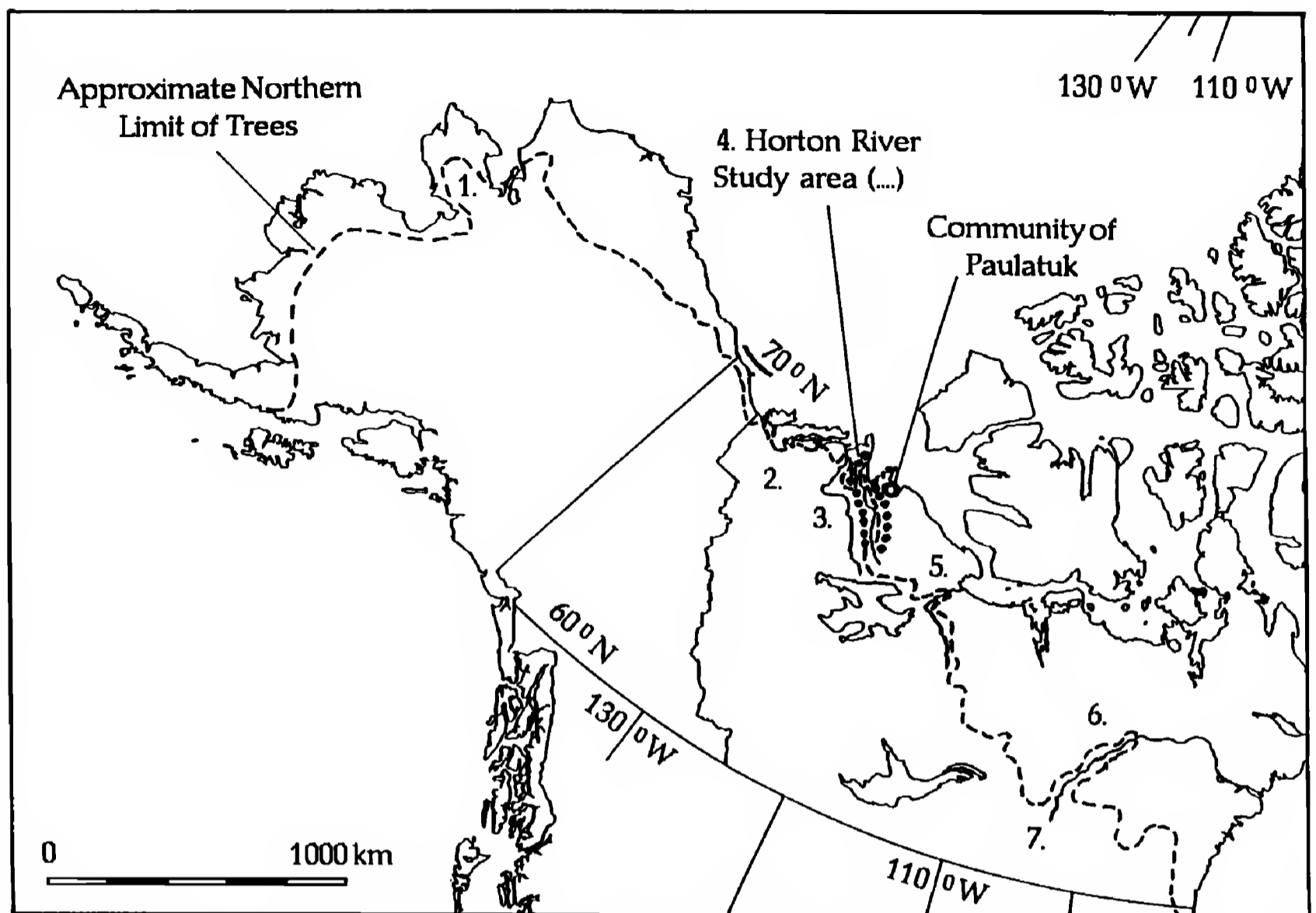


Figure 1. Location of the study area in the western Canadian Arctic, and distribution of tree-nesting gyrfalcons in North America (1. = Seward Peninsula, 2. = Sitidgi and Eskimo lakes, 3. = Anderson River, 4. = Horton River, 5. = Coppermine River, 6. = Thelon River, 7. = Clarke and Kigarvi rivers).

of the nest. More than one nest site may be present within one territory, being used in different years. Nest sites within 3 km of each other are considered alternatives, unless evidence indicates separate territories. Occupied territory or nest site—a territory or nest site where a [...] pair of birds is present at some time during the breeding season, although eggs may not be present.” Alternative tree nest sites were difficult to find, hence the number of known tree-nesting records is low compared with the number of occupied tree-nesting gyrfalcon territories

The age of nestlings was estimated (± 2 d) by comparing their pictures with photos of young of known age. To determine approximate date of egg laying, the following assumptions were made: incubation period of 35 d starting with the first egg (Cade and Weaver 1976); and a 47-d nestling period (Newton 1979).

The term “bank nest” is used for nests without nest substrate on earth ledges of high river banks. The percent overhang above the nest was calculated as described in Barichello (1983). The term “forest/tundra” was defined as the transitional zone between subarctic forest and tundra. In northern Canada and in the study area, this zone is a 100–200 km wide band which stretches across and is

centred along the northern limit of trees (Fig. 1) as plotted by Timoney (1988).

RESULTS

Description of Tree Nest Sites Used by Gyrfalcons. Tree-nesting gyrfalcons in the study area nested in nests constructed by the common raven (*Corvus corax*). There were usually 2–3 raven nests per gyrfalcon territory. Other birds did not provide suitable or available tree nests for gyrfalcons.

Twenty-two raven tree nests used by gyrfalcons were situated beside the stem or in a fork of white spruce. Nests were 5–8 above ground and 1–5 m below the tree top. They were exposed to all directional aspects and to weather. Nest trees were 6–12 m tall and located in forested river and creek valleys surrounded by tundra, and near lake shores in forest/tundra on plains.

Raven nests used by gyrfalcons contained as much

Table 1. Reproductive parameters of gyrfalcons on the Horton River, 1987–1993.^a

YEAR	NEST SITE TYPE	N	BROOD SIZE		CLUTCH INITIATION		FLEDGING DATE	
			\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
1989	Tree	2	2.0	1.4	30 Apr	2.8	21 Jul	2.8
1990	Tree	6	1.8	1.5	4 May	2.7	25 Jul	2.7
1991	Tree	4	2.5	0.6	7 May	5.5	28 Jul	5.5
1990–91	Tree	10	2.1	1.2	5 May	4.2	26 Jul	4.2
1992	Tree	5	1.8	0.8	19 May	5.4	9 Aug	5.4
1993	Tree	5	2.4	0.9	29 Apr	5.3	20 Jul	5.3
1989–93	Tree	22	2.1	1.0				
1987	Cliff	7	3.0	0.6	23 Apr	11.6	14 Jul	11.6
1990	Cliff	7	2.7	0.9	4 May	11.7	25 Jul	11.7
1991	Cliff	1	3.0	—	7 May	—	28 Jul	—
1990–91	Cliff	8	2.7	0.9	4 May	10.9	25 Jul	10.9
1987–91	Cliff	15	2.9	0.7				

^a Not included were six tree-nesting records which contained an unknown number of eggs or nestlings.

as one-third less stick and insulation material, and were smaller in size, than nearby newly built or refurbished raven nests. Of 18 tree nests utilized by gyrfalcons, 88.9% collapsed before the third year.

Breeding Density and Nest Site Selection. From 1987–1993, 16 tree-, 22 cliff-, and six bank-nesting gyrfalcon territories were found in the study area.

Mean internest distance (an index of density) of occupied gyrfalcon nest sites in the river valley was 5.3 km (SD = 1.0, $N = 10$) for clusters of tree nesters and 5.4 km (SD = 2.3, $N = 13$) for clusters of cliff-nesters. Cliff and bank nests were limited to the river valley. Raven tree nests were also in forest/tundra on plains far from the river. Mean internest distance for tree nests occupied by gyrfalcons 20–55 km from the river was 16.2 km (SD = 3.7, $N = 4$), suggesting the number of tree nesters may be significant in the expansive forest/tundra of this region.

From 1989–1993, 78.6% of 14 tree-nesting gyrfalcon territories were confirmed to be occupied every year. The same tree nests were used for 1–2 years and one for four successive years. In three territories, gyrfalcons alternated between bank and tree, tree and cliff nests in successive years in the order of bank—tree—tree (# 1), bank—tree (# 2), and tree—cliff—tree (# 3). The cliff nest (# 3) had 10% overhand protection and the accessible bank nests none. One bank nest (# 1) was used in a year when tree nests were not available. In nine tree-nesting gyrfalcon territories, alternative nest sites (6 tree, 1 cliff, and 2 bank nests) were within 25–2350 m ($\bar{x} = 947$ m, SD = 884) of previously used nest sites. Of 11 inaccessible cliff nests, eight had 100% overhang protection, and three 90%, 20% and 10% respectively, suggesting they may be more favorable and have a higher breeding success than exposed tree nests (Table 1; Fig. 2).

Reproduction and Egg/Nestling Mortality. Twenty-eight tree-nesting records by gyrfalcons were con-

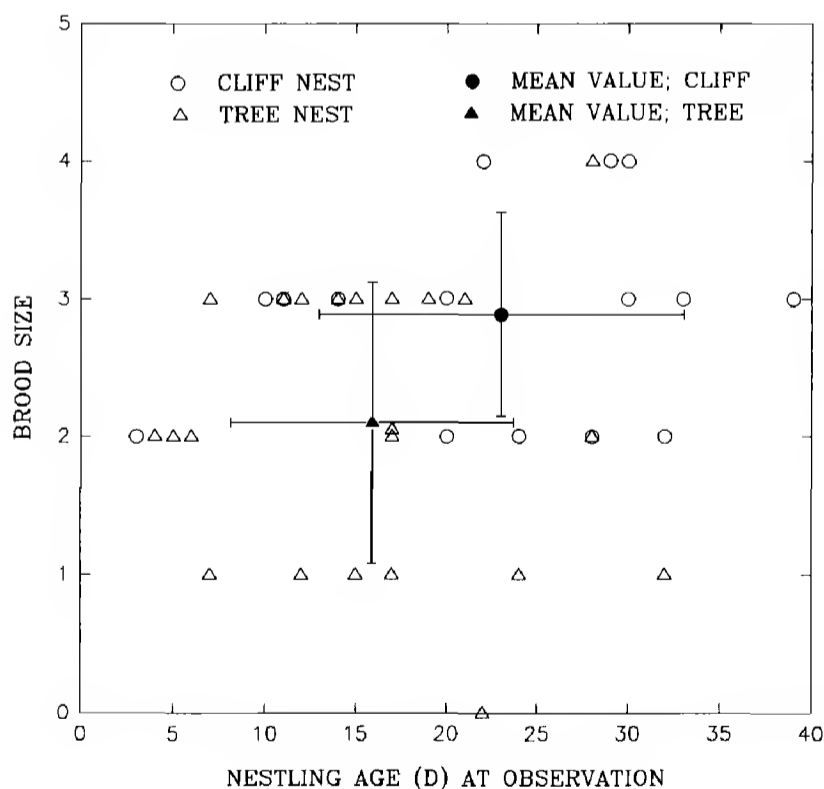


Figure 2. Age of young and brood size at day of observation for tree nests (triangles) and cliff nests (circles). Filled symbols are mean values for tree and cliff nests with bars indicating one standard deviation on either side of the mean in both age and brood size.

firmed. The mean dates of initiation of egg laying were slightly earlier for cliff than for tree nests (Table 1) and mean clutch size was 3.7 eggs (SD = 0.5, tree nests, $N = 6$; cliff nests, $N = 4$). Mean brood size was lower for tree than cliff nesters (Mann-Whitney U -test, $P = 0.026$; Table 1, Fig. 2). The average age of young at date of nest visit was 15.9 d (SD = 7.8, $N = 22$) for tree nests and 23.0 d (SD = 10.0, $N = 15$) for cliff nests (Fig. 2). This difference was significant ($t = 2.419$, $P = 0.02$). The later visit date at the cliff nests would bias cliff nests toward smaller brood sizes. Observed tendency for tree nests to contain smaller broods was therefore a robust result and egg and/or nestling mortality rate was higher in tree than cliff nests (Fig. 2). The mean age of 11 dead nestlings found beneath tree nests was 20 d (SD = 6.8).

DISCUSSION

Tree-nesting gyrfalcons reported for North America used raven nests (D.C. Heard, K.G. Poole, and D.G. Roseneau pers. comm., this study). Formerly the originators of tree nests were not clearly identified (MacFarlane 1891, Kuyt 1980). Gyrfalcons may utilize also hawk and eagle tree nests. In Eurasia, gyrfalcons used hawk and crow (*Corvus* spp.) tree nests (Dement'ev et al. 1951, Dement'ev 1960, Palmer 1988).

Gyrfalcon tree nests in the Canadian Arctic were in white spruce (Kuyt 1980, D.C. Heard and K.G. Poole pers. comm., pers. obs.) and one (T.R. Laurion pers. comm. to C.C. Shank) was in a black spruce (*Picea mariana*), which were the dominant large tree species along the tree line (Porsild and Cody 1980). In Alaska, gyrfalcons nested in a balsam poplar (*Populus balsamifera*), in Lapland in scots pine (*Pinus silvestris*), in Russia and Siberia in larch (*Larix dahurica* and *L. sibirica*) and poplar (*Populus suaveolens*), which were common tree line species (Dement'ev et al. 1951, Dement'ev 1960, D.G. Roseneau pers. comm.).

The fast deterioration of tree nests used by gyrfalcons in the study area is not unusual and was reported for stick nests in cliffs (Roseneau 1972, Cade 1982, Poole and Bromley 1988). On the Clarke River, Canadian Arctic, gyrfalcons fed their young on the ground after their tree nest collapsed in 1990 (T.R. Laurion pers. comm. to C.C. Shank).

Two reasons could explain the high mortality rate in tree nests: 1) The nests are exposed to the elements, and 2) Most nests are small and in poor

condition leading to ineffective incubation and falls from the nest.

From a review of the literature and personal communications, I identified 40 records of tree-nesting gyrfalcons, 1861–1992, across the forest/tundra of the Canadian Arctic in the following regions (Fig. 1): Thelon, Clarke and Kigarvi rivers, 11 records (Kuyt 1980, T.R. Laurion pers. comm. to C.C. Shank); Coppermine River, one record (D.C. Heard pers. comm.); Anderson River area, Sitidgi and Eskimo lakes, 28 records (MacFarlane 1981, Kuyt 1962, R.W. Fyfe pers. comm.). In Alaska, one record was reported from the Seward Peninsula (D.G. Roseneau pers. comm.).

I propose that gyrfalcons may nest in forest/tundra in other parts of North America, and suggest that this should be considered during surveys and population estimates.

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